OPERATION MANUAL

SYNTHESIZER/LEVEL GENERATOR

MG443B

ANRITSU ELECTRIC CO., LTD.

TOKYO, JAPAN

MP MASTER
MA25494

1983.11 × 70 NI-2(Y)

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MANUAL CHANGE OF MG443B

1. Introduction

This instrument is different from the standard type of MG443B, due to add Option 11. So please change to read the following modifications.

2. Modifications:

(1) Output connector

75 Ω (50 Ω) Unbalanced: Weco 439 equivalent

124 Ω Balanced: Weco 443 equivalent

135 Ω (150 Ω) Balanced : Weco 241 equivalent

600 Ω Balanced: Weco 310 equivalent

(2) Output impedance

* 75 Ω Balanced (4 k to 2 MHz) to 124 Ω Balanced (2 k to 2 MHz)

* 124 Ω Balanced Return Loss

2kHz	4kHz	2MHz
≧20 dB	≧30 dB	

(3) Page 2-1, Accessories

Delete Balanced cord 1m, Quantity 1.

Add PL11-2·3C-2Z·PL11-2 2m, Quantity 1.

N O T E

(1) The instrument is operable on a nominal voltage from 100 to 127 Vac or from 200 to 254 Vac by changing the connections of the power transformer taps.

The voltage and current rating are indicated on the rear panel when the instrument is shipped from the factory.

In the case of other voltage operation, change the connections of the power supply transformer, and the plate of voltage and current designations on the rear panel should be changed to suitable one.
Order the plates to Anritsu Electric Co., Ltd. if necessory.

(2) In this manual, a power supply voltage and current rating are represented by [**] Vac and [***] A.

(3) The relation between power supply voltage and current rating is listed below.

** Vac	*** A
100 to 127 V	2 A
200 to 254 V	1 A

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SECTION 1

GENERAL

The MG443B Synthesizer/Level Generator covers the 10 Hz to 29.999999 MHz (50Ω/75Ω unbalanced) frequency range and -80 dBm to +15 dBm output level range. Its excellent frequency resolution, switching speed, signal purity, output level accuracy and other basic performances make this instrument suitable as a measuring signal source for various apparatus, automatic measuring systems and various communications equipments from voice band to coaxial transmission band.

Furthermore, the MG443B has a universal frequency sweep (START/STOP sweep, ΔF sweep, MEMORY sweep) mode that permits selection of any sweep suited to the device under test and measuring system.

A memory function stores up to 20 operating functions for setting conditions such as output level, output impedance, output frequency, resolution and frequency sweep which can be entered from a keyboard.

The memory circuit is backed up so as to prevent destruction of the memory content when power supply is interrupted.

Output impedances of 50Ω and 75Ω unbalanced, and 75Ω, 135Ω, 150Ω and 600Ω balanced are available. The output level can be set in the range from -80 dBm to +15 dBm directly from the keyboard, and also is variable in the step size which is input from the keyboard. Moreover, the output level is continuously variable over ±2 dB by means of a fine adjustment dial.

SECTION 2

COMPOSITION AND SPECIFICATIONS

2.1 Composition

Table 2.1 shows the standard composition of this instrument.

Table 2.1 Standard Composition

Item	Name	Quantity	Remarks
Instrument	MG443B Synthesizer/Level Generator	1	
Accessories	3CA-P2·RG-58A/U·3CA-P2 1m	1	for 50Ω
	3CV-P2·3C-2V·3CV-P2 1m	1	for 75Ω
	Balanced cord 1m	1	
	Power cable	1	
	Fuse	2	***A
	Operation manual	1	
	Service manual	1	

2.2 Specifications

Table 2.2 shows the specifications of the MG443B.

Table 2.2 Specifications

<table>
<tr><td rowspan="4">Frequency</td><td>Range</td><td colspan="5">50Ω and 75Ω unbalanced: 10 Hz to 29.999999 MHz
75Ω, 135Ω and 150Ω balanced: 4 kHz to 2 MHz
600Ω balanced: 200 Hz to 150 kHz</td></tr>
<tr><td>Resolution</td><td colspan="5">1 Hz</td></tr>
<tr><td>Accuracy</td><td colspan="5">Depends on the accuracy of the reference oscillator.</td></tr>
<tr><td>Reference oscillator stability</td><td colspan="5"><table>
<tr><th colspan="2"></th><th>Standard</th><th>Option 01</th><th>Option 02</th><th>Option 03</th></tr>
<tr><td rowspan="2">Starting characteristics</td><td>After 30 min operation</td><td>$\leqq 1\times10^{-7}$ /day</td><td>$\leqq 7\times10^{-8}$ /day</td><td>—</td><td>—</td></tr>
<tr><td>After 60 min operation</td><td>$\leqq 5\times10^{-8}$ /day</td><td>$\leqq 3\times10^{-8}$ /day</td><td>$\leqq 2\times10^{-8}$ /day</td><td>—</td></tr>
<tr><td colspan="2">Aging rate (after 24 hours warm-up)</td><td>$\leqq 2\times10^{-8}$ /day</td><td>$\leqq 5\times10^{-9}$ /day</td><td>$\leqq 2\times10^{-9}$ /day</td><td>$\leqq 5\times10^{-10}$ /day (after 48 hours warm-up)</td></tr>
<tr><td colspan="2">Stability of crystal oscillator to variation in ambient temperature (25° ±35°C)</td><td>$\pm 5\times10^{-8}$</td><td>$\pm 5\times10^{-8}$</td><td>$\pm 1.5\times10^{-8}$</td><td>$\pm 5\times10^{-9}$</td></tr>
</table></td></tr>
<tr><td>Output level</td><td>Range</td><td colspan="5">50Ω unbalanced: -80 to +9 dBm (-90.79 to -1.78 dB/0.775 V)
75Ω unbalanced: -80 to +15 dBm (-89.03 to +5.97 dB/0.775 V)
75Ω balanced: -80 to +10 dBm (-89.03 to +0.97 dB/0.775 V)
135Ω balanced: -80 to +10 dBm (-86.48 to +3.52 dB/0.775 V)
150Ω balanced: -80 to +10 dBm (-86.02 to +3.98 dB/0.775 V)
600Ω balanced: -80 to +10 dBm (-80 to +10 dB/0.775 V)</td></tr>
</table>

Table 2.2 Specifications (Cont'd)

Output level

Resolution

LEVEL CONTINUOUS OFF: 0.01 dB

LEVEL CONTINUOUS ON: Min. ≧4 dB continuously variable

Accuracy

At ALC-NORMAL and LEVEL CONTINUOUS OFF

1) 75Ω unbalanced

	10Hz	7MHz	13MHz	29.999MHz
+15dBm	±0.2 dB	±0.3 dB	±0.4 dB	
+10dBm	±0.15dB	±0.2dB		
-52dBm	±0.2 dB	±0.3dB		
-80dBm				

2) 50Ω unbalanced

	10Hz	7MHz	13MHz	29.999MHz
+9dBm	±0.3 dB	±0.4 dB	±0.5 dB	
+5dBm	±0.25dB	±0.3dB		
-56dBm	±0.3 dB	±0.4dB		
-80dBm				

3) 75Ω, 135Ω, and 150Ω balanced

	4kHz	2MHz
+10dBm	±0.25dB	
-52dBm	±0.3dB	
-80dBm		

Table 2.2 Specifications (Cont'd)

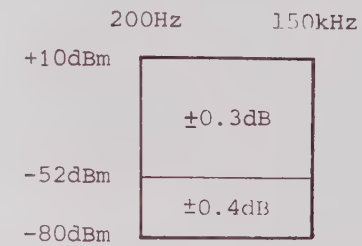
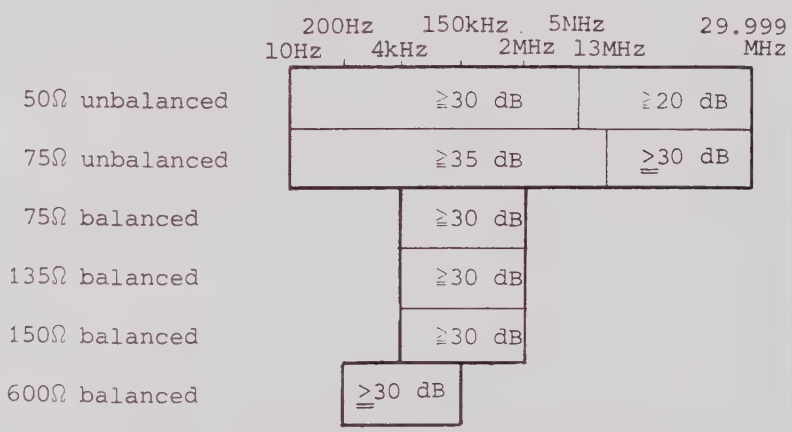
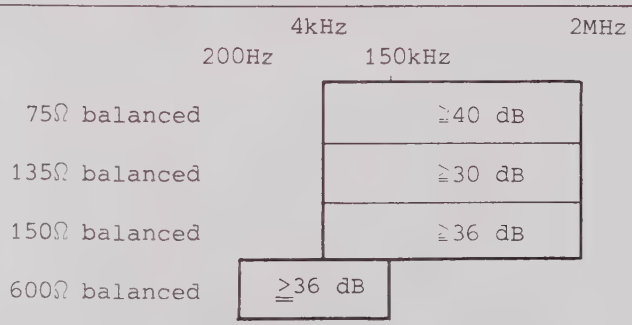
Output level	Accuracy	4) 600Ω balanced 
	Frequency characteristic	±0.07 dB at 75Ωunbalanced and output level +5 dBm
Signal output	Return loss	At output level ≦ 0dBm 
	Balance	

Table 2.2 Specification (Cont'd)

<table>
<tr><td rowspan="4">Signal purity</td><td>Harmonic content (2nd and 3rd)</td><td>At ALC-NORMAL (below 4 kHz) and ≦0 dBm output

<table>
<tr><td></td><td>10Hz</td><td>50Hz</td><td>2MHz</td><td>20MHz</td><td>29.999MHz</td></tr>
<tr><td>50Ω } un-
75Ω } balanced</td><td>≦-45 dBc</td><td>≦-55 dBc</td><td>≦-50 dBc</td><td colspan="2">≦-45 dBc</td></tr>
</table>

<table>
<tr><td></td><td>4kHz</td><td>2MHz</td></tr>
<tr><td>75Ω
135Ω } balanced
150Ω</td><td colspan="2">≦-55 dBc</td></tr>
</table>

<table>
<tr><td></td><td>200Hz</td><td>150kHz</td></tr>
<tr><td>600Ω balanced</td><td colspan="2">≦-55 dBc</td></tr>
</table>
</td></tr>
<tr><td>Spurious</td><td>10 Hz to 30 MHz: ≦-70 dBc or ≦-115 dBm</td></tr>
<tr><td>Single side band phase noise</td><td>
<table>
<tr><td>Offset frequency from carrier</td><td>2 kHz</td><td>10 kHz</td><td>50 kHz</td></tr>
<tr><td>At carrier frequency 20MHz</td><td>≦-95 dBc/Hz</td><td>≦-100 dBc/Hz</td><td>≦-105 dBc/Hz</td></tr>
</table>
</td></tr>
<tr><td rowspan="5">Sweep</td><td>Frequency sweep</td><td>° Start/stop
° Center/ΔF</td></tr>
<tr><td>Memory sweep</td><td>° 20 functions (memorized)</td></tr>
<tr><td>Sweep mode</td><td>° Repeat
° Single</td></tr>
<tr><td>Sweep width</td><td>Max. 29.999989 MHz</td></tr>
<tr><td>Sweep time</td><td>Min. 2 msec/point
(60 msec/point when any function other than frequency is switched in the case of memory sweep)

Max. 9999 msec/point
(not including the time of level blanking)</td></tr>
<tr><td></td><td>Level stabilization time</td><td>Time required for the level to reach within 0.1 dB of the final value (with LEVEL BLANKING OFF)

ALC-NORMAL: 500 msec (typical)
ALC-FAST: 2 msec (typical)

(60 msec to be added when any function other than frequency is switched in the case of memory sweep)</td></tr>
</table>

Table 2.2 Specifications (Cont'd)

Modulation	Amplitude	Frequency range	50 Hz to 50 kHz at carrier frequency ≦3 %
		Percentage modulation	typ. 45% at 0 dBm input
		Distortion factor	≦-15 dB at 0 dBm output and 80% modulation
		Input impedance	600Ω
	Phase	Frequency range	DC to 5 kHz
		Phase shift range	±6 π radian
		Input impedance	600Ω
Blanking (Fade out / Fade in)			Max. value ≧65 dB
External control	Method		GP-IB (IEEE 488)
	Interface function		SH1, AH1, RL1, PP0, DC1, DT0, C0, SR0, T7, L3
	Listener function		All front panel setting functions excepting level continuous control and power switch
	Talker function		Front panel setting information excepting power switch
	Listen only		Frequency
	Talk only		Frequency
Auxiliary input and output	Reference oscillator output		1) 10 MHz TTL level (STD output) 2) 10 MHz TTL level (buffered output)
	Reference oscillator input		10 MHz TTL level
	Tracking input		800 Hz to 30 MHz
	External modulation AM input		≦±5 V
	X-axis		0 to 2V, sawtooth wave
	Z-axis		TTL level
Ambient temperature, rated range of use			0°C to 50°C

Table 2.2 Specifications (Cont'd)

Storage temperature	-40 to +70°C
Power	** V ac ±10%, 50/60 Hz ≦ 100 VA (or 10VA during stand-by)
Dimensions and weight	132.5H × 426W × 450D mm, ≦14 kg

SECTION 3

PRINCIPLES OF OPERATION

3.1 General

Frequency synthesizers are classified into two basic types according to the method of frequency synthesis; indirect and direct types. The indirect type uses 1/N frequency dividers, etc. to phase lock to the frequency taken from a reference crystal oscillator. The direct type does not phase lock but uses frequency multipliers, frequency dividers, modulators, etc. to derive its output frequency from the reference crystal oscillator. Both types have advantages from the standpoints of resolution, signal purity, switching speed and other basic performance and economics.

The MG443B employs the indirect method which is economically advantageous, and improves the signal purity and switching speed. The MG443B consists of a reference frequency generator section to supply the signal of a reference crystal oscillator to various other sections, a local oscillator section to produce 62 to 92 MHz synthesized frequencies, a BFO (beat frequency oscillator) section to convert the local oscillator frequency into the output frequency and stabilize the output level, a frequency-level control section that performs frequency and level control, and a power supply section. Fig. 3.1 shows a block diagram of the MG443B.

3.2 Principles of Operation

3.2.1 Reference frequency generator section

The reference frequency generator section provides reference frequency for other sections by 10 MHz crystal oscillator mounted on the constant temperature oven.

3.2.2 Local oscillator section

The local oscillator section provides an output frequency variable in 1 Hz steps between 62.000010 MHz and 91.999999 MHz.
This section consists of four phase locked loops, PLLI for 2 MHz steps, PLLII to produce 10 kHz digit frequencies, PLLIII to produce 1 Hz digit frequencies, and PLLIV, a frequency synthesizer part for synthesis of these loops.
Any of PLLI to PLLIII employs the 1/N method and provides the required frequency by varying the frequency dividing ratio of the frequency divider.
In PLLIV, frequencies obtained in PLLI to PLLIII are synthesized directly or after frequency division, to provide the final output frequency of 62 to 92 MHz.

3.2.3 BFO section

The BFO section converts the local oscillator frequency into the required output frequency (10 Hz to 29.999999 MHz). Further, it stabilizes the output level by amplification up to a predetermined level and then adjusts it through an output attenuator to the required level before outputting.
The BFO section consists of a frequency converter to convert the frequency of 62 to 92 MHz into 0 to 30 MHz, a 62 MHz oscillator which is phase locked with the 10 MHz reference frequency, a voltage variable attenuator for level stabilization and AM modulation and level blanking, an output amplifier having a gain of about 40 dB and capable of outputting up to +15 dBm, a detector to detect the output level, an output attenuator, and an output impedance switching device.
The frequency converter is a ring modulator having a high intercept point. The operating level is the local oscillator frequency level +10 dBm and the signal level -25 dBm.

The 62 MHz oscillator is phase locked by phase comparison of the signal obtained by 1/31-division of the output frequency of the voltage controlled oscillator with the 2 MHz reference signal obtained by 1/5-division of the 10 MHz reference signal.
The voltage variable attenuator is a diode attenuator providing an attenuation of more than 70 dB by a voltage of 0 to 10 V. By superimposing an ac voltage (modulation signal for AM modulation) on a dc voltage, AM modulation can be applied. In applying level blanking, voltage setting is done so as to make the attenuation of this attenuator maximum.
The output amplifier is a flat amplifier having an overall gain of 40 dB consisting of a pre-amplifier with a good NF (noise figure) and a power amplifier with small output distortions.
The detector is a high-stability detector employing a detector diode in the feedback circuit of a high gain amplifier. By application of ALC, the stability and the flatness of the output level of the MG443B are determined by this detector.
The output attenuator is a programmable attenuator using a high reliability mechanical relay variable in 2 dB x 1, 4 dB x 1, 8 dB x 1, 16 dB x 1 and 32 dB x 2 steps.
The output impedance switching device consists of an impedance converter to transform the 75Ω unbalanced signal into 50Ω unbalanced signal, and a transformer for converting the 75Ω unbalanced signal into the 75Ω, 135Ω, 150Ω, or 600Ω balanced output.

3.4.2 Control section

This section performs setting of parameters (frequency, level, impedance, etc.), computational operation and interfacing to external instruments (through GP-IB). All the information from the operation panel and external instruments is controlled through the control section.

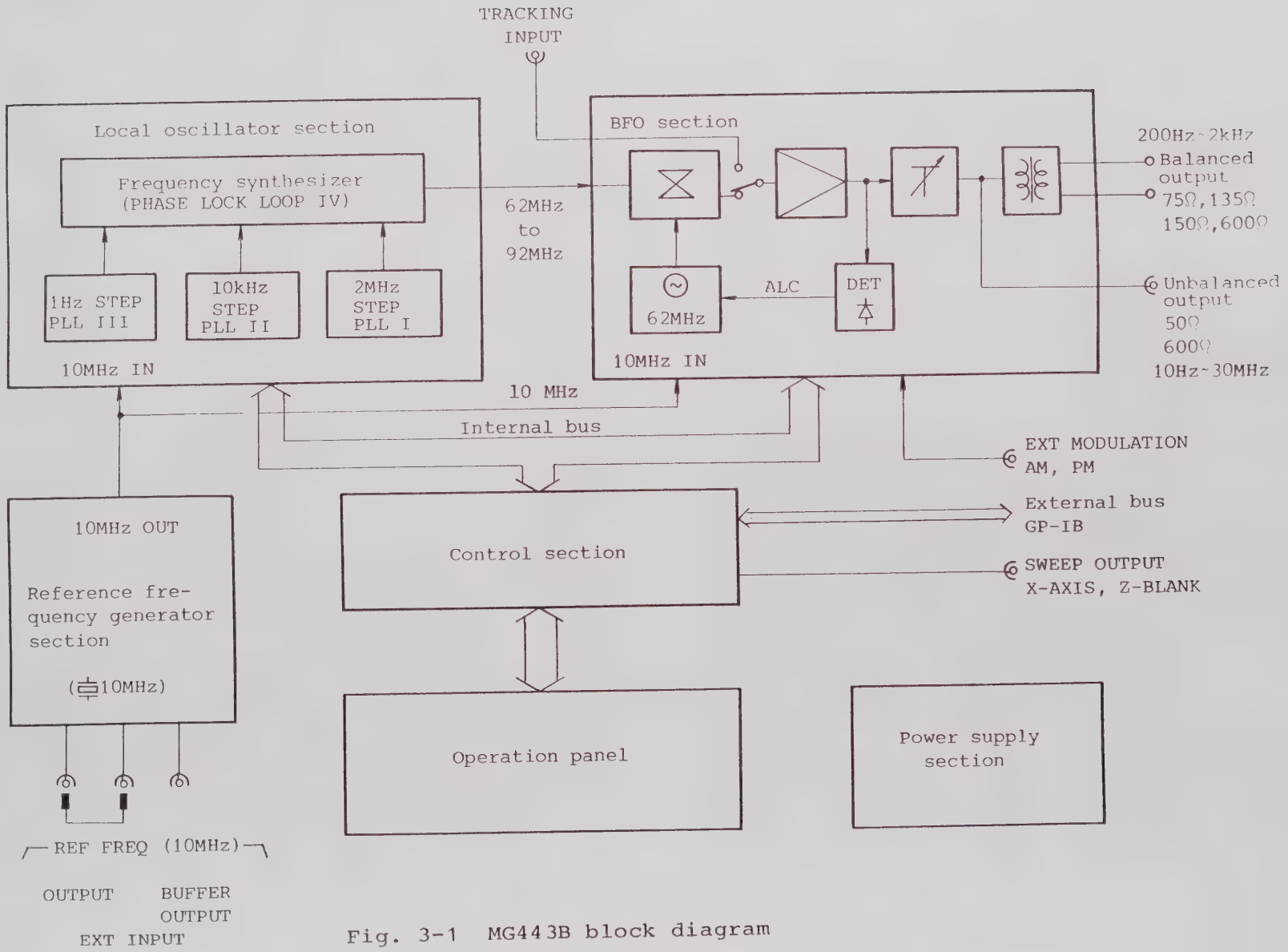


Fig. 3-1 MG443B block diagram

SECTION 4

PREPARATIONS

4.1 Power Requirement

The MG443B operates properly on **V ±10% (60 Hz/ 50 Hz).

4.2 Location of Installation, and Environmental Conditions

The MG443B is designed to operate properly in the environment of 0° to +50°C ambient temperature and to endure storage in the environment of -40° to +70°C ambient temperature. In order to maintain stable operation for a long time, it is advisable to use or store the instrument in a place which is as free from moisture, dust or dirt, etc. as possible.
For high precision measurements, it is desirable to use the instrument in a place which is subjected to less vibrations and less temperature and humidity variations.

4.3 Warm-up of Reference Crystal Oscillator

With the power cord of the MG443B plugged into an ac outlet, the auxiliary power supply for crystal oscillator is turned on. For high precision measurements, a warm-up time is necessary and therefore, the power cord should be plugged into the ac outlet beforehand.
For the warm-up time, refer to 5.3.1.

SECTION 5

OPERATING INSTRUCTIONS

5.1 Description of Knobs, Keys and Connectors

Refer to Fig. 5.1 and Fig. 5.2.

(1) POWER ON/STAND BY

ac power switch. At STAND BY, when the ac power cord plug (24) is connected to an ac outlet, the reference crystal oscillator is warmed up.

(2), (3) OUTPUT

(2) is an unbalanced output connector for 50Ω, 75Ω.

(3) is a balanced output connector for 75Ω, 135Ω, 150Ω, 600Ω.

(4) IMPEDANCE

Output impedance switching key. Each time the key is depressed, switching is made to 50Ω → 75Ω → 135Ω → 150Ω → 600Ω in succession.

(5) LEVEL STEP

Key for varying the output level up or down in the step set by means of ten-keys.

(6) CONTINUOUS

Key for turning on or off the output level fine adjustment function.

(7) CONTINUOUS

Knob for continuous adjustment of the output level in minimum reading of 0.02 dB. Variable over ±2dB.

(8) RESOLUTION

To set the resolution of the tuning dial.
When the key of [▶] is depressed, resolution becomes fine (minimum 1 Hz).
When the key of [◀] is depressed, resolution becomes coarse (maximum 10 MHz).
The resolution being set is displayed by "▼" mark on the frequency display. When the key is continuously depressed, "▼" mark moves continuously.

(9) TUNING

Tuning dial to vary the output frequency with the resolution set by means of RESOLUTION (8).

(10) STEP

To vary the output frequency in the step size being set.
When the key of [▲] is depressed, the output frequency is increased.
When the key of [▼] is depressed, the output frequency is decreased.
In case the setting by depression of the key is outside the frequency range (10 Hz to 31.999999 MHz), this function does not work.
The step size is set by the DATA ENTRY at (11).

(11) DATA ENTRY

To perform settings regarding frequency and level. The setting method will be described in detail in paragraph 5.2.

(12) OFFSET ENTRY

If this instrument is to be used in frequency tracking through GP-IB with other measuring instrument, the frequency offset between both instruments can be set by this key.

The setting method will be described in detail in paragraph 5.2.

⑬ CENTER/ΔF, START/STOP, MEMORY

To perform switching of sweep functions (CENTER/ΔF, START/STOP and MEMORY).

⑭ REPEAT/SINGLE

To perform switching of sweep modes (REPEAT and SINGLE).

⑮ START/STOP

Key to designate START or STOP of sweep. During sweep, the sweep is stopped, or during stop of sweep, the sweep is started.

⑯ STATUS

Key for switching to manual operation during GP-IB control.

⑰ OFFSET

Key for turning on and off the frequency offset.
At SLG, the frequency of the MG443B is offset.
At SLM, the frequency of the ML422A/B/C Selective Level Meter is offset.
This function is effective only in the GP-IB ONLY mode.

⑱ FREQUENCY TIME

Frequency and sweep time display.

⑲ OUTPUT LEVEL

Output level display.

⑳ dBm, dB/0.775V

dBm (1mW=0dBm), dB/0.775V (0dBm=0.775V at 600Ω) selection switch.

㉑ ALC

Key for turning FAST and NORMAL the Automatic Level Control Circuit. If high speed sweep is necessary, this key should be set to FAST.
Normally, it is set to NORMAL.

㉒ BLANKING

Key for effecting the "soft" blanking function. If it is desired to suppress unwanted components as far as possible when frequency and level vary, this key should be set to ON.
Normally, it should be set to OFF.

㉓ EXT MOD

Key for operating PM or AM modulation circuit.

㉔ INPUT (TRACKING)

Input connector for tracking with the ML422B/C SLM. This connector is used with ㉕ at ON.

㉕ TRACKING ON-OFF

To be turned to ON if analog tracking with the ML422B/C SLM is desired. The output frequency in this case is determined by the ML422B/C SLM.
Normally, it should be set to OFF.

㉖ REF FREQ (10 MHz) OUTPUT

Output connector for internal reference crystal oscillator. (Output level is TTL level.)

(27) REF FREQ (10 MHz) EXT INPUT

Input connector to be used when use of external reference (10 MHz TTL level) is desired. To use this connector, connection of U-link of (29) should be removed.
Normally, it should be connected by the U-link of (29) to (26).
NOTE: If this connection is absent, normal output signal is not provided.

(28) REF FREQ (10 MHz) BUFFERED OUTPUT

Reference signal (10 MHz TTL level) output to be used when this instrument is used in digital tracking (through GP-IB) with the ML422A/B/C, or in like cases.

(29) U-link

Used for connection of (27) to (26).

(30) Address switch

Address switch of GP-IB. Used to give the MG443B a specific address or to effect ONLY mode.

(31) GP-IB

Connector for connection of GP-IB cable.

(32) EXT MOD INPUT PM

Input connector for Phase Modulation signal.

(33) SWEEP OUTPUT X-AXIS

Output connector for sweep signal (X-axis).

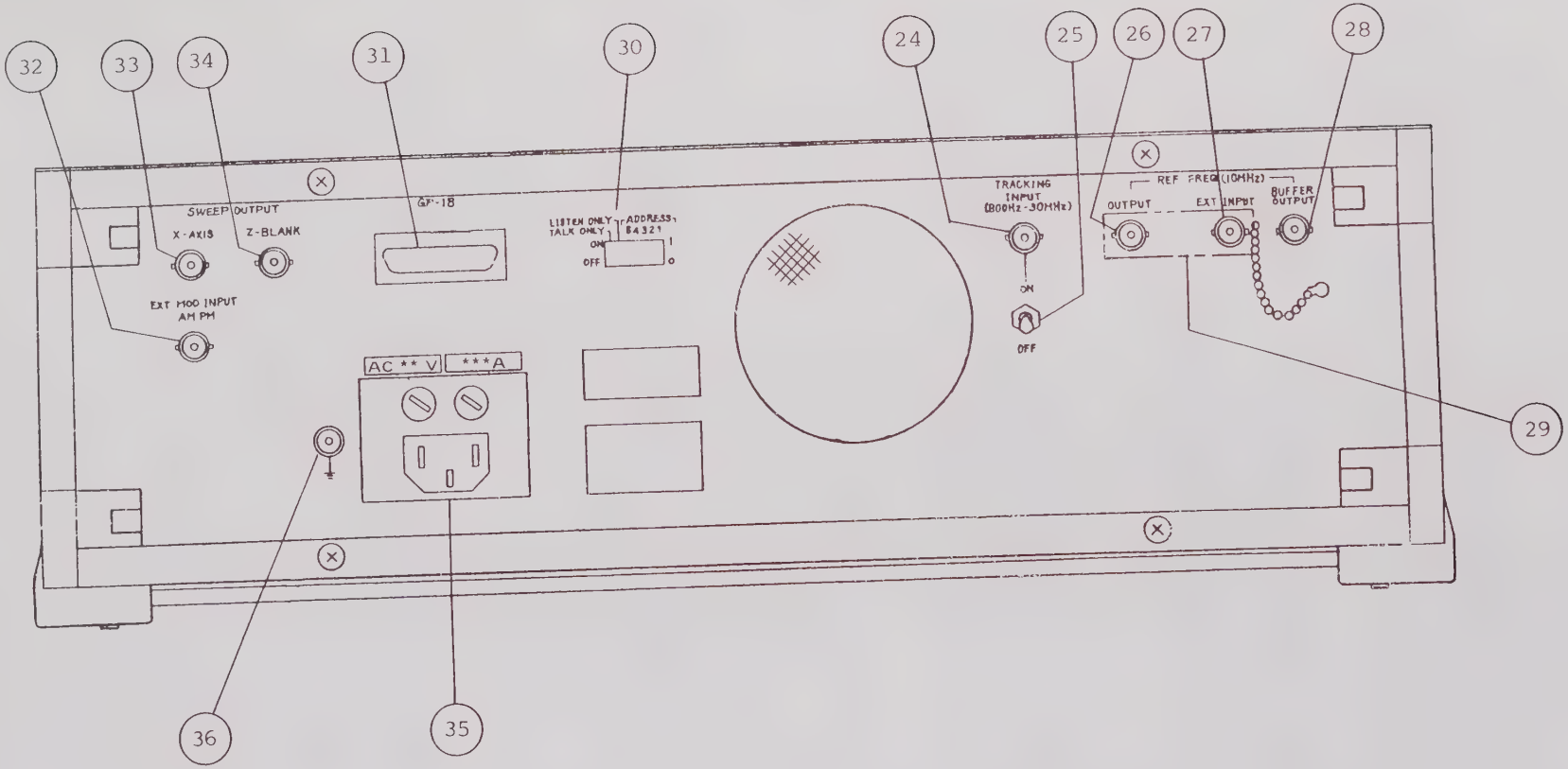


Fig. 5.2 MG443B Rear Panel

5.2 Description of DATA ENTRY keys and associated keys and dials

Take for example the case of setting the output frequency and the output level of the MG443B.
Fig. 5.3 shows the arrangement of DATA ENTRY keys. The data set by means of DATA ENTRY keys is displayed on the frequency and time display or on the output level display.
In most cases, proceed in the sequence of:

item to be set → data (numerical value) → unit

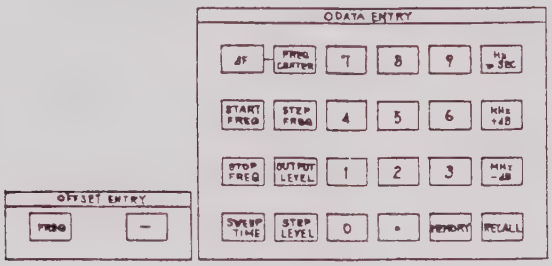


Fig. 5.3 Arrangement of DATA ENTRY keys

5.2.1 Setting the output frequency

(Example 1)

Set the output frequency to 542 Hz. (Assume that the output frequency before setting was 1 MHz.)

Key operation	Display	Output frequency
FREQ CENTER	1000 000 —MHz— —kHz— —Hz msec— • DATA ENTRY lights up	1.000 000 MHz
5	5 —MHz— —kHz— —Hz msec—	
4	54 —MHz— —kHz— —Hz msec—	
2	542 —MHz— —kHz— —Hz msec—	1.000 000 MHz
Hz mSEC	542 —MHz— —kHz— —Hz msec— ° DATA ENTRY goes out	542 Hz

(Example 2)

Set the output frequency to 455.362 kHz. (Assume that the frequency before setting was 542 Hz.)

Key operation	Display	Output frequency
FREQ CENTER	542 —MHz— —kHz— —Hz msec— • DATA ENTRY lights up	542 Hz
4	4 —MHz— —kHz— —Hz msec—	
5	45 —MHz— —kHz— —Hz msec—	
5	455 —MHz— —kHz— —Hz msec—	
•	455. —MHz— —kHz— —Hz msec—	
3	455.3 —MHz— —kHz— —Hz msec—	
6	455.36 —MHz— —kHz— —Hz msec—	
2	455.362 —MHz— —kHz— —Hz msec—	542 Hz
kHz -dB	455 362 —MHz— —kHz— —Hz msec— ° DATA ENTRY lamp goes out.	455.362 kHz

(Example 3)

Set the output frequency to 21.345987 MHz.
The display and the output frequency indicate similarly to (Example 1) and (Example 2).

Key operation

5.2.2 Setting STEP FREQ (Setting the step size of FREQUENCY STEP ▲ and ▼ keys)

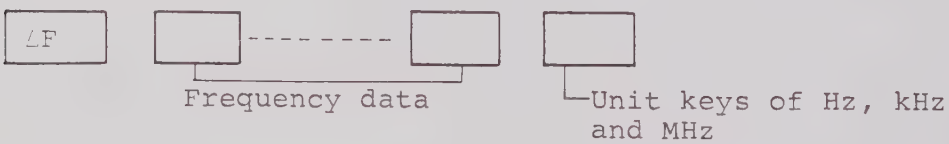
The display indicates similarly to (Example 1) and (Example 2) in 5.2.1, but the output frequency does not vary. At the same time that DATA ENTRY lamp goes out, the output frequency is displayed on the display.

Key operation

5.2.3 Setting ΔF (Setting the sweep width of ΔF sweep)

The display indicates similarly to (Example 1) and (Example 2) in 5.2.1, but the output frequency does not vary. At the same time that DATA ENTRY lamp goes out, the output frequency is displayed on the display.

Key operation



5.2.4 Setting START FREQ (Setting the START frequency of START/STOP sweep)

The display indicates similarly to (Example 1) and (Example 2) in 5.2.1.

Key operation

5.2.5 Setting STOP FREQ (Setting the STOP frequency of START/STOP sweep)

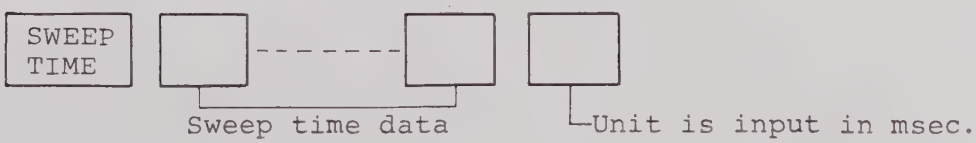
The display indicates similarly to (Example 1) and (Example 2) in 5.2.1.

Key operation

5.2.6 Setting SWEEP TIME (Setting the time per point of sweep)

The display indicates similarly to (Example 1) and (Example 2) in 5.2.1, but the output frequency does not vary. At the same time that DATA ENTRY lamp goes out, the output frequency is displayed on the display.

Key operation



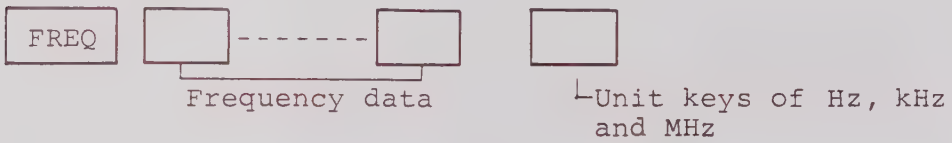
5.2.7 Setting OFFSET FREQ (Setting the frequency offset from the selective level meter with which this instrument is to be used in frequency tracking)

The display indicates similarly to (Example 1) and (Example 2) in 5.2.1, but the output frequency does not vary. At the same time that DATA ENTRY lamp goes out, the output frequency is displayed on the display.

Key operation (1)

When frequency variations of the S/LG and the SLM are in the same directions

OFFSET ENTRY



Key operation (2)

When frequency variations of the S/LG and the SLM are in the opposite directions

OFFSET ENTRY

5.2.8 Setting OUTPUT LEVEL

When the unit display on OUTPUT LEVEL display is dBm, the output level is displayed in dBm, and when the unit display is dB/0.775V, the output level is displayed in dB/0.775V.

(Example 1)

Set the output level to -19.38 dBm.
After confirming that the unit display is dBm, proceed as follows. (Assume that the output level before setting was 0.00 dBm.)

Key operation	Display	Output level
OUTPUT LEVEL	0.00 ● dBm ○ dB/0.775V • DATA ENTRY lights up	0.00 dBm
1	1 ● dBm ○ dB/0.775V	
9	19 ● dBm ○ dB/0.775V	
.	19 ● dBm ○ dB/0.775V	
3	19.3 ● dBm ○ dB/0.775V	
8	19.38 ● dBm ○ dB/0.775V	0.00 dBm
MHz -dB	-19.38 ● dBm ○ dB/0.775V ○ DATA ENTRY goes out	-19.38 dBm

(Example 4)

Recall the panel condition stored at address .0.

Key operation

[RECALL] [.] [0]

(Example 5)

Recall the panel condition starting with that stored at address 8 and proceeding to those addresses incremented or decremented in succession.

Key operation

[RECALL] [8] ..... This instrument is set to the panel condition stored at address 8.

[RECALL] ..... FREQUENCY STEP [▲] and [▼] keys operate as memory address increment and decrement keys.

[▲] ..... This instrument is set to the panel condition stored at address 9.

[▲] ..... This instrument is set to the panel condition stored at address .0.

[▲] 5 times ..... This instrument is set to the panel condition stored at address .5.

[▼] ..... This instrument is set to the panel condition stored at address .4.

[▼] 4 times ..... This instrument is set to the panel condition stored at address .0.

[▼] 10 times ..... This instrument is set to the panel condition stored at address 0.

[Hz] ..... FREQUENCY STEP [▲] and [▼] keys operate as original frequency step up and down keys to vary the frequency in the step size being set.

NOTES:

(1) In case an incorrect data is entered in the course of entry, restart from the beginning.

(2) In case frequency setting is outside the frequency range, the frequency is set to 29.999999 MHz, or to a frequency obtained by neglecting that part of the set frequency which is below 10 Hz or 1 Hz.

(3) When the frequency is varied by means of FREQUENCY STEP [▲] and [▼] keys or TUNING dial, the contents of the data input by means of [FREQ CENTER] are also varied.

(4) In case output level setting is outside the output level range, the output level is set to +15.00 dBm equivalent, or to -80 dBm equivalent, or to a level obtained by neglecting that part of the set level which is below 0.01 dB.

(5) When the output level is varied by means of LEVEL STEP [▲] and [▼] keys, the contents of the data input by means of [OUTPUT LEVEL] are also varied.

(6) When LEVEL CONTINUOUS is ON, the step size of LEVEL STEP [▲] and [▼] keys is 2 dB irrespective of the data input by means of [STEP LEVEL].

5.3 Precautions for Frequency Setting

5.3.1 Warm-up time

For stable measurements, the reference crystal oscillator must be adequately warmed up. Table 5.1 shows the frequency stability of the reference crystal oscillator.

Table 5.1 Reference crystal oscillator stability

		Standard	Option 01	Option 02	Option 03
Starting characteristics	After 30 minutes operation	$\leqq 1\times10^{-7}$ /day	$\leqq 7\times10^{-8}$ /day	——	——
	After 60 minutes operation	$\leqq 5\times10^{-8}$ /day	$\leqq 3\times10^{-8}$ /day	$\leqq 2\times10^{-8}$ /day	——
Aging rate (after 24 hours warm-up)		$\leqq 2\times10^{-8}$ /day	$\leqq 5\times10^{-9}$ /day	$\leqq 5\times10^{-9}$ /day	$\leqq 5\times10^{-10}$/day (after 48 hours warm-up)

NOTE: With the power cord plugged into the ac outlet, the reference crystal oscillator is heated even when the POWER switch is in the STAND-BY position. To make stable measurements, plug the power cord into the ac outlet beforehand.

5.3.2 External reference crystal oscillator

To use an external reference crystal oscillator instead of the internal reference crystal oscillator, proceed as described in Table 5.2.

Table 5.2 Procedure for external reference crystal oscillator

(1)	Check that the output frequency of the external reference crystal oscillator is within 10.000000 MHz ±100 Hz.
(2)	Check that the output level of the external reference crystal oscillator is TTL level.
(3)	Disconnect the U-link (29) and connect the output of the external reference crystal oscillator to EXT INPUT (27).

5.4 How to Use Various Frequency Setting Methods

5.4.1 Setting the frequency by means of TUNING dial

By means of TUNING dial, the frequency can be varied. The step size can be selected freely at 1 Hz, 10 Hz, ... 1 MHz and 10 MHz by means of RESOLUTION ◀ and ▶ keys. This method can be used conveniently for checking of the center frequency, cut-off frequency of a filter, etc.

5.4.2 Setting the frequency by means of STEP ▲ and ▼ keys

By means of STEP ▲ and ▼ keys, the frequency can be varied in the step size input by DATA ENTRY keys. For example, assume that the step size is set at 4 kHz (input as [FREQ STEP] [4] [kHz + dB]) and the current output frequency is 60 kHz, then the frequency can be varied as follows.

By each depression of ▲ key ... 64 kHz, 68 kHz, 72 kHz
By each depression of ▼ key ... 68 kHz, 64 kHz, 60 kHz, 56 kHz

By depressing ▲ key or ▼ key continuously, the frequency can be varied continuously in 4 kHz steps.

5.4.3 Setting the frequency by means of DATA ENTRY keys

Refer to (Example 1), (Example 2) and (Example 3) in 5.2.1.

5.4.4 Setting the frequency by CENTER/ΔF sweep

In the CENTER/ΔF sweep mode, digital sweep is done over the range of the center frequency ±ΔF (for the setting of ΔF, refer to 5.2.3) divided into 100 points. The center frequency is the frequency set by the setting method of (Example 1), (Example 2) or (Example 3) in 5.2.1 or the frequency set by means of TUNING dial or STEP [▲] and [▼] keys.

5.4.5 Setting the frequency by START/STOP sweep

In the START/STOP sweep mode, digital sweep is done over the range divided into 100 points with START frequency at the frequency set by the method in 5.2.4 and STOP frequency at the frequency set by the method of 5.2.5.

5.4.6 Setting the frequency by MEMORY sweep

In the MEMORY sweep mode, sweep is done recalling the contents at memory addresses from 0 to .9 in succession.
Since each memory is a function memory, this method is best suited to the sweep while varying the setting of various conditions such as output level, impedance, modulation or no-modulation, etc.

5.5 How to use various level setting methods

5.5.1 Setting by means of DATA ENTRY keys

For the setting method, refer to 5.2.8.
By using the setting by means of DATA ENTRY keys, the required level can be obtained immediately with a precision of 0.01 dB.

5.2.2 Setting by means of LEVEL STEP ▲ and ▼ keys

By means of LEVEL STEP ▲ and ▼ keys, the output level can be varied in the step size input by means of DATA ENTRY keys.
For example, assume that the linearity of an amplifier is to be examined at 5 dB intervals, then the output level can be varied in 5 dB steps by setting the step size to 5 dB (input as [STEP LEVEL] [5] [kHz + dB]).

5.5.3 Setting by means of CONTINUOUS dial

With CONTINUOUS at ON, the output level can be varied by means of CONTINUOUS dial.
By using this function, level setting below 0.01 dB is made possible. Therefore, this function can be used conveniently when it is desired to set the output level below 0.01 dB or vary the output level continuously.
With CONTINUOUS at ON, the step size of LEVEL STEP ▲ and ▼ keys is 2 dB irrespective of the contents of DATA ENTRY. Therefore, in case the variable width (over ±2 dB) of CONTINUOUS is exceeded, the output level can be varied further by using LEVEL STEP ▲ and ▼ keys in conjunction.

5.6 How to use BLANKING function

If the frequency or the level is varied suddenly, the spectrum will spread momentarily due to the step response. For example, in the maintenance of telephone lines, if such a spectral spread occurs, it will adversely affect adjacent channels.

The BLANKING function operates, when the frequency is varied suddenly or when the level is varied suddenly, to suppress the spectral spread by allowing the output level to decrease with adequate slow slope, and after the next frequency or the next output level is set and stabilizes, to return again with adequate slow slope to the required level.

The BLANKING function, which prevents occurrence of unwanted signals as described above, can be used conveniently in the maintenance of telephone lines in service or in like cases where it is desired to prevent occurrence of unwanted signals.

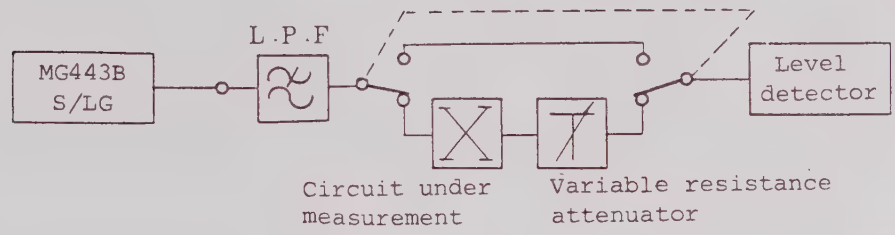
5.7 Examples of Measurement

5.7.1 Gain and loss measurements

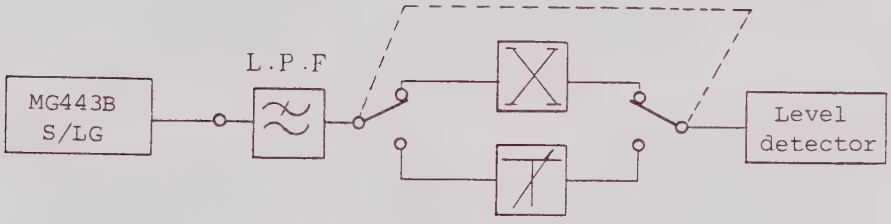
Although gain and loss can be measured with the block shown in Fig. 5.4, operation is simpler when a wideband instrument such as a flat level meter or electronic voltmeter is used as the level detector. However, large loss, etc. cannot be measured and accurate results cannot be expected because of the effects of noise and harmonics outside the measuring frequency. High accuracy measurements can be made by rejecting these unwanted components by using a selective level meter as the level detector.

Moreover, the MG443B which is provided, as a standard, with GP-IB can be operated in digital tracking with a selective level meter which is also provided with GP-IB,

as shown in Fig. 5-5, one as listener only and the other as talker only, permitting labor saved measurement.



(a) Gain measurement



(b) Loss measurement

Fig. 5-4 Gain and loss measurements

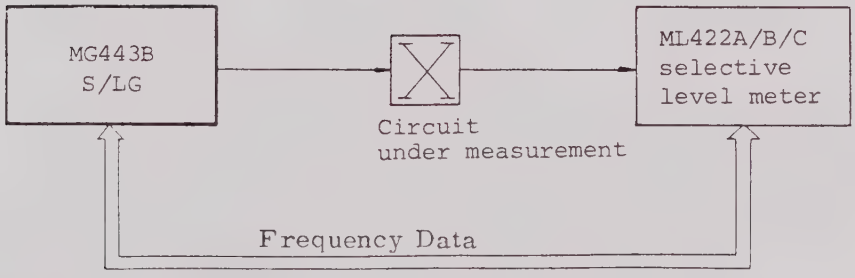


Fig. 5.5 Digital tracking block diagram

5.7.2 Automatic Measurement

Since the frequency and output level of the MG443B can be externally controlled through GP-IB, an automatic measuring system can be built by combining the MG443B with a personal computer or minicomputer provided with GP-IB function as a center and other peripheral devices. Fig. 5.6 shows a typical automatic measuring system using GP-IB. This instrument can be used as an automatic measuring signal source for various communication circuits, measuring signal source for systems or equipment, etc. See section 6 for a detailed description of GP-IB.

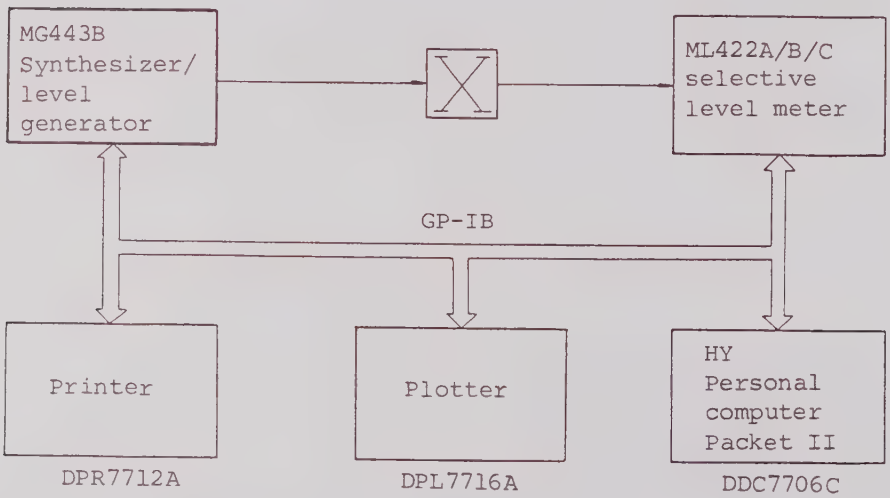


Fig. 5.6 Automatic transmission characteristics measuring system

SECTION 6

GP-IB

6.1 Description

MG443B Synthesizer/Level Generator GP-IB is an interface based on IEEE 488 recommendations and is installed in the MG443B cabinet.

6.2 GP-IB System Outline

The GP-IB system electrically and mechanically standardizes the interface for devices having diverse functions, connects the devices to one bus line and transmits data among devices through this bus line.

6.2.1 Outline

The block diagram of the GP-IB system is shown in Fig. 6.1.

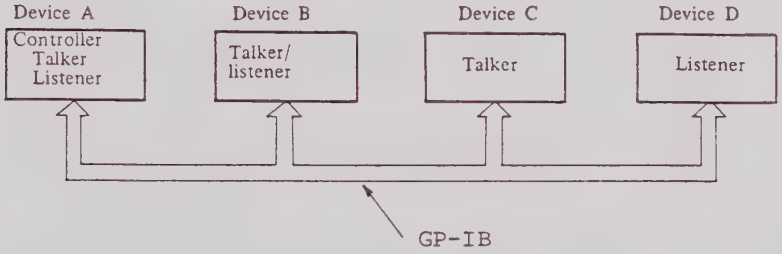


Fig. 6.1 GP-IB System Block Diagram

In Fig. 6.1 four devices are connected as an example. However, this interface bus system can connect up to a maximum of 15 devices.
The functions of the devices can be classified into three groups with each device belonging to any group.

a) Controller

This controls the overall system. A computer or calculator generally has this function.
The controller is capable of specifying itself or other devices as the listener and talker.
Two or more controllers may be attached to one bus system, but only one can be operated as the controller at one time.

b) Talker

This is a device that has been given the capability to send data to other devices. This function is enabled only when the device is specified as a talker. Two or more talkers cannot exist at the same time at one bus system.

c) Listener

This is a device that has been given the capability to receive data from the talker. This function is enabled only when the device has been specified as a listener. One bus system can contain multiple listeners.

The three system elements have been described above. However, the actual devices often have all these functions. For example, a calculator can be operated as controller, talker, and listener as different times.

6.2.2 Description of Bus Line

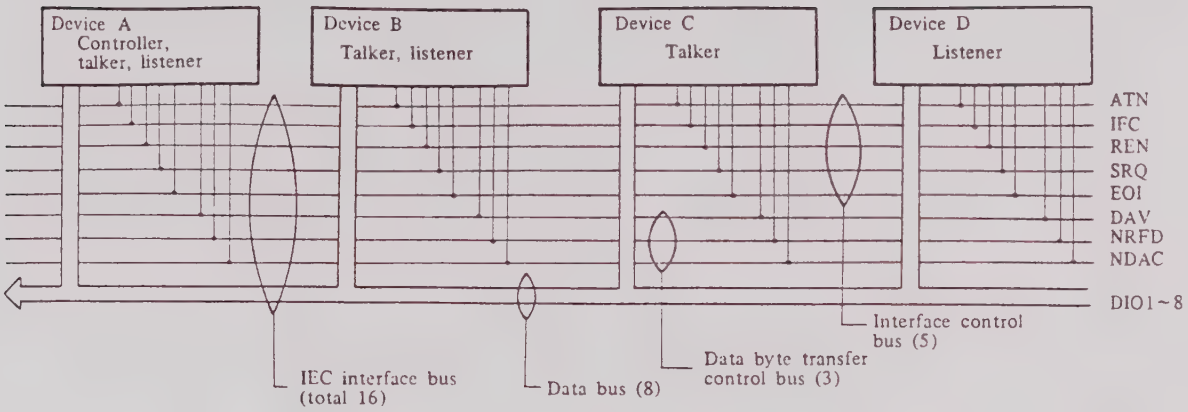


Fig. 6.2 Construction of Bus Line

As shown in Fig. 6.2, the bus line consists of 16 signal lines functionally divided into the following three buses:

1) Data bus (DI01 ~ DI08)

This bus consists of 8 signal lines and is used to transfer data between devices and to send various commands from the controller to other devices. The data and command transfer format is bit parallel, byte serial.

2) Data byte transfer control bus (DAV, NRFD, NDAC)

This bus consists of 3 signal lines and is used to send messages placed on the data bus by the talker to the listener.
The process of sending data by means of these three signal lines is called 3 wire handshake.
The role of each of the three signal lines is as follows:

° DAV (Data Valid)

This line indicates that the data on the data bus are effective. This line is controlled by the controller or talker.

° NRFD (Not Ready For Data)

This signal line indicates that the listener is not ready to receive the data on the data bus. This line is controlled by the listener.

° NDAC (Not Data Accepted)

This line indicates that the listener has not accepted the data on the data bus. It is controlled by the listener.

3) Interface control bus (ATN, IFC, REN, SRQ, EOI)

This bus consists of five signal lines and is concerned with control of the overall bus system. The operation of each signal line is given below.

° ATN (Attention)

This line controls the controller and discriminates the meaning of the data on the data bus. (Discriminates between command or address and data.)
When this line is TRUE, the data on the data bus are address or command and all the devices must receive data by participating in three wire handshake.
When this line is FALSE, the data on the data bus are general data and only the specified (addressed) devices participate in three wire handshake and transfer data. At this time, the other devices are irrelevant.

° IFC (Interface Clear)

This line sets the initial conditions and is controlled by the controller.

° REN (Remote Enable)

This line is controlled by the controller and is used to control whether the devices are remote or local in accordance with the other messages (commands).

° SRQ (Service Request)

This line is used when an interruption is generated for the controller. Each device controls this line.

° EOI (End Or Identify)

This line is used to indicate the end of transfer of several bytes of data. It is controlled by the talker.

6.2.3 Three Wire Handshake

As previously described, the three lines DAV, NRFD and NDAC are used to reliably transfer data and command between devices. The relationship between these three lines and the devices is shown in Fig. 6.3 (Time chart) and Fig. 6.4 (Flow chart).
The GP-IB bus logic and signal names will be described here as necessary precautions regarding Fig. 6.3 and Fig. 6.4. The GP-IB bus is negative logic. That is, LOW level indicates that a signal is present. For example, when DAV (Data Valid) is LOW level, it indicates that the data to be transferred are on the bus line. However, on the 16 signal lines, NRFD (Not Ready For Data) and NDAC (Not Data Accepted) are functionally positive logic. When NRFD is HIGH level, for example, it indicates that the device is ready to accept data at RFD (Ready For Data). Therefore, if this is considered to be negative logic, it has the meaning of negation at RFD and becomes Not Ready For Data NRFD as the function of the line when LOW level.

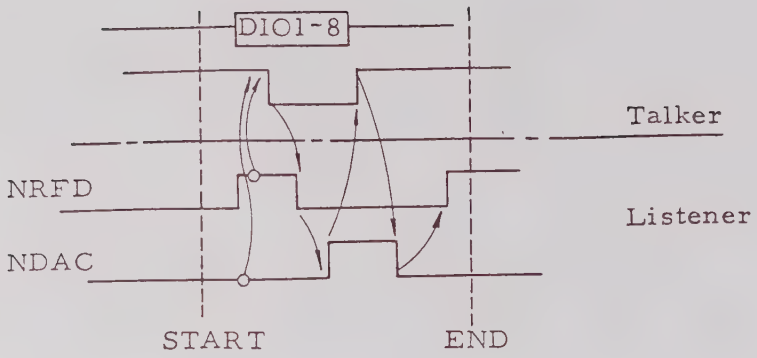
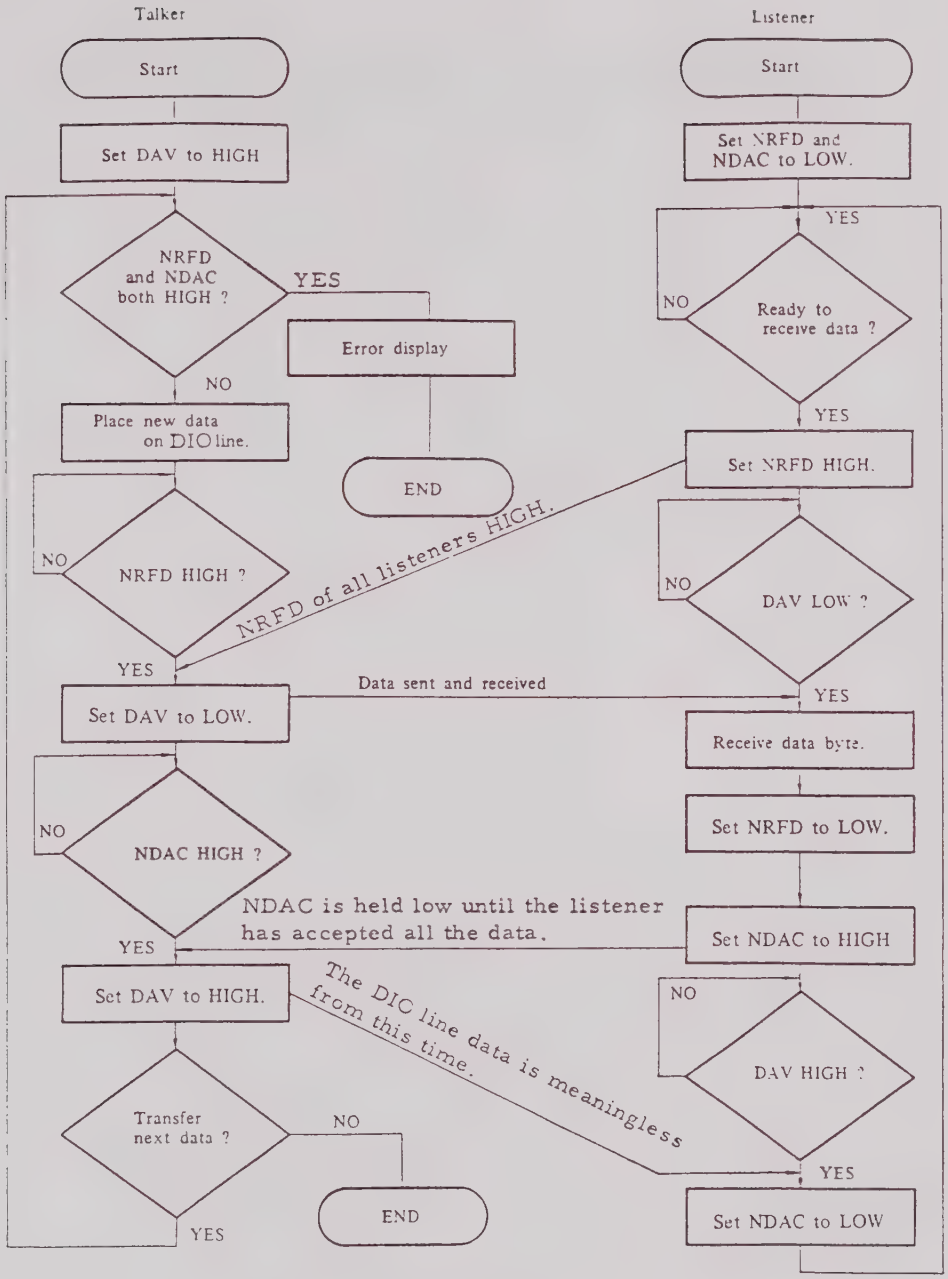


Fig. 6.3 Three Wire Handshake Time Chart



This handshake is performed one time, each time the talker sends data to the listener. DAV is controlled by the talker and NRFD and NDAC are controlled by the listener.

Fig. 6.4 Three Wire Handshake Flow Chart

Table 6.1 USA Standard Code for Information Interchange (ASC II)

b7 b6 b5 / BITS					0_0	0_1	$0_1 0$	$0_1 1$	$1_0 0$	$1_0 1$	$1_1 0$	$1_1 1$
b_4	b_3	b_2	b_1	Column / Row	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	;
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Note 3 (b7 b6 b5)

Note 3 (b4 b3 b2 b1)

Note 1

Note 2

Note 1: GP-IB valid LISTEN addresses

Note 2: GP-IB valid TALK addresses

Note 3: Logic 1=0 V

NOTE: Since bit 1 is ON in the address switch setting example of Fig. 6.5, the talk address is "A" and the listen address is "!".

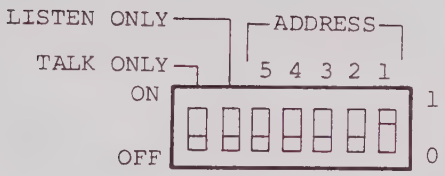


Fig. 6.5 Address Switches

6.3 Handling

6.3.1 Setting the Address Switches

Each device attached to GP-IB is assigned by a unique address which must be set. The address consists of a 7-bit code. Bit 7 and bit 6 are used to discriminate between talk address and listen address. The other five bits are used to identify the device.

	b7	b6	b5	b4	b3	b2	b1
Talk address	1	0	A_5	A_4	A_3	A_2	A_1
Listen address	0	1					

At each device A5 ~ A1 is set and whether or not the combination of bits b5 ~ b1 of the address code from the controller match this bit configuration is monitored. When they match, the device is made a talker or listen according to the combination of bit 7 and bit 6.

6.3.2 Address switch setting

The address of this instrument is set by address switches on the rear panel. Talk only/listen only mode are set as shown in Tables 6.2, 6.3.

Table 6.2 Talk Only Mode Setting

TALK ONLY	LISTEN ONLY	ADDRESS 5	4	3	2	1
ON	OFF	×	×	×	×	×

Table 6.3 Listen Only Mode Setting

TALK ONLY	LISTEN ONLY	ADDRESS 5	4	3	2	1
OFF	ON	×	×	×	×	×

The device addresses can be selected within the range shown in Note 1 and Note 2 of the ASCII code table of Table 6.1. However, codes in which bit 1 to bit 5 are all "1" are prescribed as unlisten command or untalk command and cannot be used.

6.3.3 Cable Connection

Up to a maximum of 15 devices can be connected to the GP-IB system. But since the length of the connection cable is limited as follows, care must be exercised.

a. Length per cable must be 2 m or less.

b. Overall length of cable must be 20 m or less.

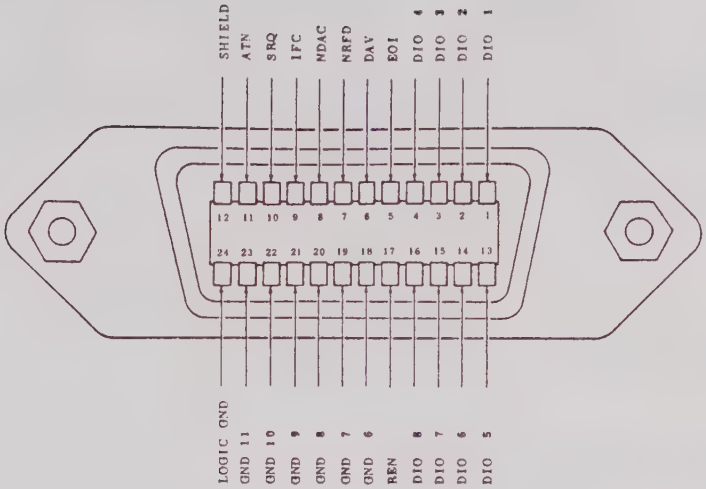


Fig. 6.6 GP-IB Interface Connector Pin Arrangement

6.3.4 Control System

Remote/Local Switching Function

Specifying the listen address when the REN line is active switches to the remote mode. Executing the GTL (addressing command cord,

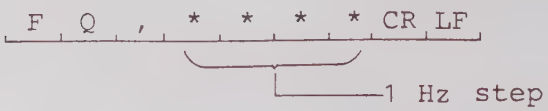
X	0	0	0	0	0	0	1

) when the REN line is Active, or False REN line, switches to the local mode.

Instruction Code

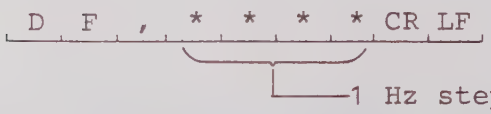
Instruction code is shown as follows.

(1) Setting the frequency — EREQ / CENTER

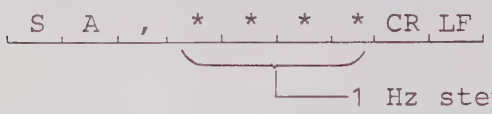


(2) Setting the step frequency — STEP / FREQ

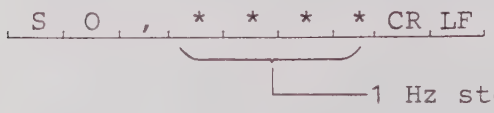
(3) Setting the sweep ΔF — ΔF



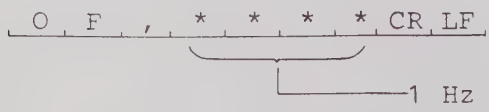
(4) Setting the sweep START frequency — START / FREQ



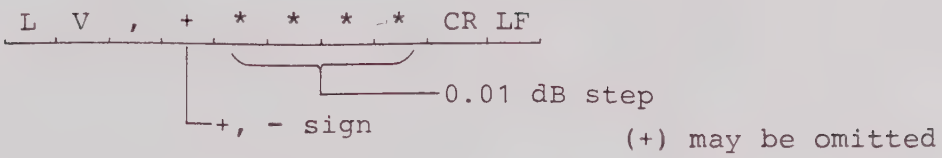
(5) Setting the sweep STOP frequency — STOP / FREQ



(6) Setting the offset frequency — OFFSET ENTRY / FREQ

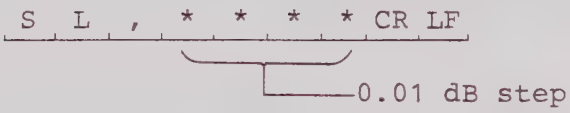


(7) Setting the output level OUTPUT LEVEL

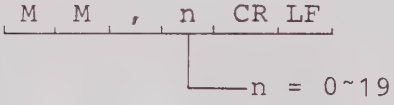


(+) may be omitted

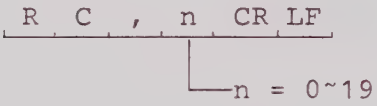
(8) Setting the step level STEP LEVEL



(9) Setting the function memory MEMORY



(10) Setting the function recall RECALL



(11) Frequency step up and down with the step frequency

F U CR LF ; Frequency step up

F D CR LF ; Frequency step down

(12) Output level step up and down with the step level

L U CR LF ; Output level step up

L D CR LF ; Output level step down

(13) Setting the resolution RESOLUTION

R E , n CR LF

n=1 ; 1 Hz
2 ; 10 Hz
3 ; 100 Hz
4 ; 1 kHz
5 ; 10 kHz
6 ; 100 kHz
7 ; 1 MHz
8 ; 10 MHz

(14) Setting the output impedance OUTPUT IMPEDANCE

O I , n CR LF

n=1 ; 50 Ω unbalanced
2 ; 75 Ω unbalanced
3 ; 75 Ω balanced
4 ; 135Ω balanced
5 ; 150Ω balanced
6 ; 600Ω balanced

(15) Setting dBm or dB/0.775V dBm dB/0.775V

D B , n CR LF

n=1 ; dBm
2 ; dB/0.775V

(16) Setting ALC ALC

A L , n CR LF

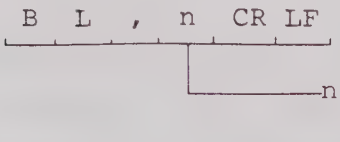
n=1 ; FAST
2 ; NARMAL

(17) Setting EXT MOD (external modulation) ON or OFF EXT MOD

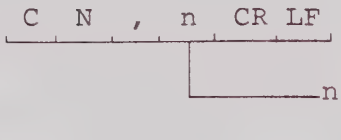
E M , n CR LF

n=0 ; OFF
1 ; ON

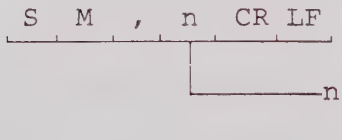
(18) Setting BLANKING ON or OFF BLANKING



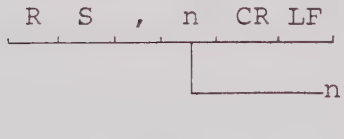
(19) Setting CONTINUOUS ON or OFF CONTINUOUS



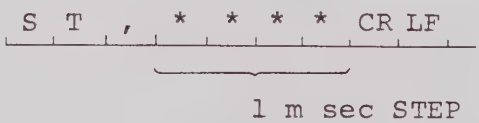
(20) Setting the sweep mode SWEEP MODE (CENTER/ΔF / START/STOP / MEMORY (MAX20))



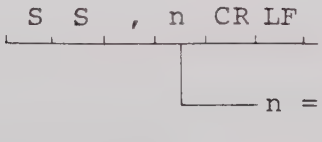
(21) Setting the sweep mode REPEAT / SINGLE



(22) Setting the sweet time SWEEP TIME



(23) Setting the sweep START/STOP START STOP



(NOTES)

(1) For data reading from the MG443B, add "T" to the head of message (above shown abbreviations, two alphabetical digits) of the requested item and send them to the MG443B, so specify the MG443B to talker.

(2) Once the MG443B is specified as a listener, more than one message can be transferred with the instruction code format of one line when those messages are separated by a comma. Here is an example of Anritsu PACKET II Personal Computer

(Example) WRITE 1 :"FQ1000000, LV-1000, AL 1, OI 1,"
(CR)(LF)

Output frequency=1 MHz
Output level=-10.00
ALC 1= FAST
Output impedance 1= 50 Ω unbalanced

Note that the number of the data characters acceptable from one line is less than or equal to 60 characters with the CR and LF included.

(3) ONLY mode, turn on the power supply switch of the listen only devices before turning on the power switch of the MG443B when used as a talk only.
Care should be taken because data cannot be transferred to the listen only side if the power switch of the MG443B is turned on before the listen only devices are powered.

SECTION 7

PERFORMANCE CHECK

Performances can be checked by the following methods.

Specifications listed in Table 2-2 are standards for the check.

Caution:

1. Perform the check at room temperature after first warming up the MG443B synthesizer/Level Generator (see Table 5-1 for warming up time).
2. All instruments used for the performance check must also be warmed up before use.

7.1 Instruments Required for Performance Check

Table 7-1 Instruments Required for performance check

Measuring item	Required performance	Recommended model
Output level	Standard level meter 10 Hz ~30 MHz	ML423A
Relative high frequency contents and spurious signal	Spectrum analyzer 10 kHz~1700 MHz	MS62B
Single side band noise and phase noise	Low-pass filter	M-238C
	Selective level meter (r.m.s. value detection type)	ML422A
	dc voltmeter (Voltage range ±10V, Accuracy ±0.05V)	
	Level meter 10Hz~20 MHz	ML424A
Switching time	Oscilloscope (dc~15 MHz)	
	Low-pass filter	M-238C
	Synthesizer (10Hz~30 MHz)	MG440B

7.2 Measurement of Output Level Accuracy and Frequency Characteristics

1. Specifications

Level accuracy: ±0.1 dB at 10 Hz to 13 MHz,
(75Ω UNBALANCE) ±0.2 dB at 13 MHz to 29.999 MHz

Level frequency characteristics:
(75Ω UNBALANCE) With 1 MHz and 5 dBm as reference
Within ±0.05 dB (10 Hz to 13 MHz)
Within ±0.1 dB (13 MHz to 29.999 MHz)

2. Connection diagram

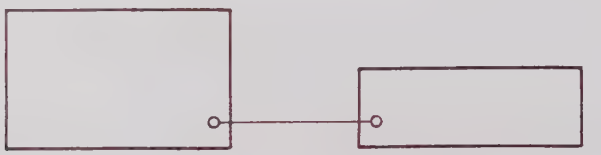


Fig. 7.1 Output level measurement

3. Measurement procedures

(1) Output level accuracy

Connect the MG443B OUTPUT to the standard level meter ML423A. Set the MG443B output frequency to 1 MHz and check for correct specifications.

(2) Frequency characteristics

Same as (1), except change the synthesizer output frequencies.

7.3 Measurement of Relative Harmonic Contents and Spurious Signals

1. Specifications

Relative harmonic contents:
Both 2nd and 3rd harmonics
≦-60 dBc (when 1 MHz 0 dBm)
(dBc: dB below the carrier level)

Spurious signal: ≦-70 dBc
(Output level is at 0 dBm)
≦-60 dBc
Depends on phase noise for ac line frequency and its harmonics.

2. Connection diagram

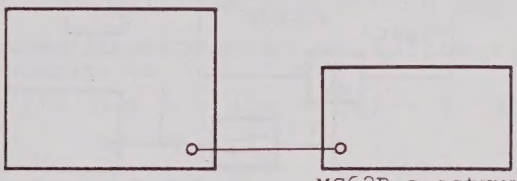


Fig. 7.2 Spurious signal measurement

3. Measurement procedures

Connect the MG443B output to the spectrum analyzer, MS62B.
Be careful as too great an input to the spectrum analyzer can cause internal distortion. In such a case use an additional RF ATT.
Also be careful that if there is a device that generates large waves or other oscillator in the neighborhood, the spectrum analyzer may receive signals from them directly.

7.4 Measurement of Single-Sideband Phase Noise

1. Specification

Offset frequency from carrier	2kHz	10kHz	100kHz
Carrier frequency 499.999 MHz	≦-105dBc/Hz	≦-110dBc/Hz	≦-115dBc/Hz

2. Connection diagram

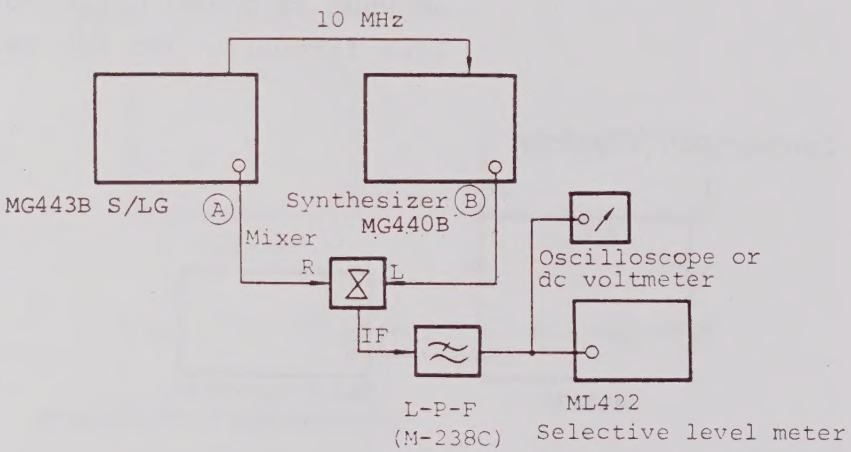


Fig. 7.3 Single side band phase noise measurement

3. Measurement procedures (SSB phase noise measurement at 10 MHz output frequency)

(1) Connect Buffer OUTPUT on the MG443B rear panel to the other STD INPUT.
(for synchronization of B, the measuring synthesizer and A, the MG443B to be measured.)

(2) Set the MG443B output to 10 MHz, -10 dBm.
(Place at a point of mixer linearity.)

③ Set the B synthesizer at 10.01 MHz, +6 dBm. (Mixer local level)

④ Place in a position to filter 10 MHz through the low-pass filter.

⑤ 10 kHz beats are output from the low-pass filter.

⑥ Measure 10 kHz level with the ML422A/B/C. Level of this measurement is Ls (dB).

⑦ Set the B synthesizer (10.01 MHz) to 10.000 MHz.

⑧ Adjust the B synthesizer phase to make the low-pass filter OUT output within ±0.1V
(In this state, there is no signal from the low-pass filter OUT, only SSB noise is generated.)

⑨ The IF passband width of the ML422A/B/C at this time is B (Hz) and the meter reading is Lx dB.

The SSB phase noise at a point 10 kHz from the carrier (10 MHz) can be expressed as follows:

$$C/N = -[10 \log B + (Lx - Ls) + 6] \text{ dB}$$

$$BW = 1 \text{ Hz}$$

NOTE: 1. The SSB phase noise at the point 100 kHz and 2 kHz apart are measured in the same way using ML422A/B/C at the 100 MHz point.

2. If Selective Level Meter measures the mean value, add 1.05 dB to the above value.

7.5 Switching Time Measurement

1. Specifications

Response time is typicaly 1 msec.

2. Connection diagram

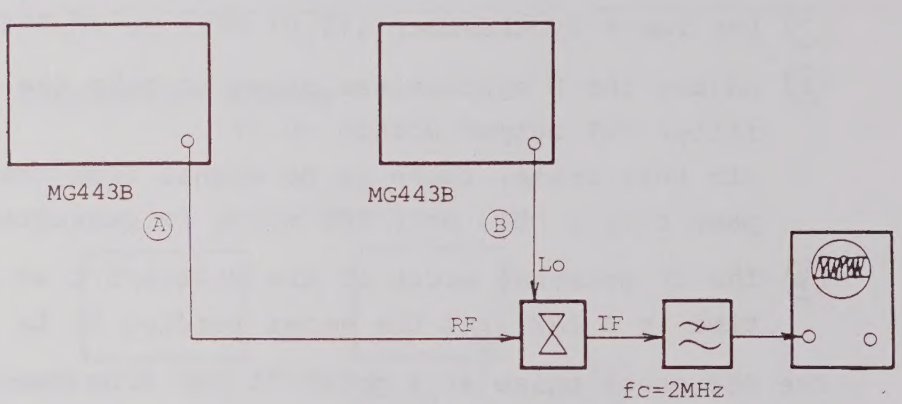


Fig. 7.5 Switching time measurement

3. Measurement procedures (switching from 10 MHz to 15 MHz)

① Set MG443B Ⓐ (to be measured) to 10.000 MHz/ -10 dBm.

② Set MG443B Ⓑ to, for example, 15 MHz/+6 dB.

③ Filter 10 MHz and 9 MHz through the low-pass filter.

④ Nothing is displayed on MIXER IF OUT (oscilloscope) at this item.

⑤ Switch MG443B Ⓐ to 15 MHz.

⑥ Measure the time for the amplitude to become DC with the oscilloscope.

MP MASTER
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